Global Change Effects on Coral Reef Condition

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Coral reefs have experienced unprecedented levels of bleaching, disease, and mortality during the last three decades. Various stressors have led directly and interactively to this decline. Global climate and land-use changes are among these including elevated water temperature, increased exposure to ultraviolet radiation, and degraded water quality. Continued losses will affect the high number and diversity of marine organisms reliant on coral reef habitat. Over one million species are associated with coral reef ecosystems. Coral reef species support numerous subsistence and commercial fisheries, a thriving tourist economy, and the promise of new pharmaceutical products.

Management of coral reef areas will require an understanding of which species, reefs, and areas are most valuable, most at risk, and most amenable to management strategies. NHEERL's Gulf Ecology Division integrates field and laboratory studies to address these issues; field surveys characterize habitat value and condition, whereas laboratory studies examine the differential susceptibility of various coral species and dinoflagellate clades to atmospheric and land-use stressors. Iterative comparisons will identify the most significant stressors and implicate potential management actions. Values, risks, and potential management actions are an ongoing part of a collaborative effort of NHEERL with ORD's National Center for Environmental Assessment (NCEA), National Center for Environmental Research (NCER), and National Exposure Research Laboratory (NERL) to evaluate the effects of global change on coastal ecosystems.

NHEERL has introduced a promising field method to provide indicators of reef habitat value, health, and growth and reproductive capacity. In a rapid survey, total and living coral surface area is estimated for each colony identified in a 113m^2 radial belt transect. A pilot project performed in the Florida Keys and Dry Tortugas demonstrated that the method was logistically feasible, data were reasonably reproducible, and the potential to identify at-risk species, size classes, and reef areas was exceptional. Reef-to-reef comparisons are less complicated using this method because surface area measurements are not confounded by differences in species composition. Corals are being digitally photographed and modeled in a software program to develop species-specific surface area formulas and evaluate size class and living tissue rankings. Data collected from future surveys will be used with data from other ORD Laboratories and Centers to evaluate the significance of global change stressors.